

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2019/2020

EEL1166 – CIRCUIT THEORY (All sections / Groups)

11th March 2020
9.00 a.m. – 11.00 a.m.
(2 Hours)

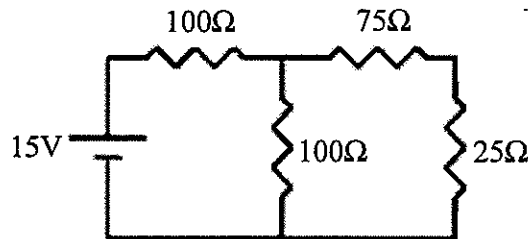
INSTRUCTIONS TO STUDENTS

1. This question paper consists of **FIVE** pages including cover page with **FOUR** questions only.
2. Answer **ALL** questions and print all your answers in the answer booklet provided.
3. All questions carry equal marks and the distribution of the marks for each question is given.

Question 1

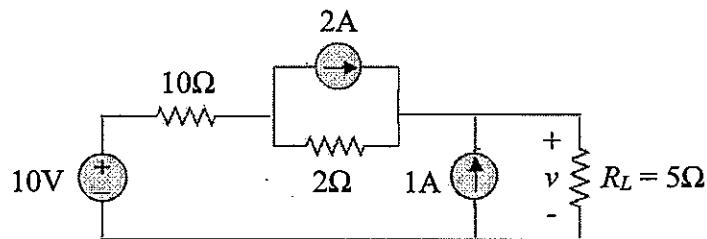
(a) For circuit shown in **Figure Q1(a)**,

- (i) Explain briefly how the current is generated and flowed in the circuit with the given voltage. [2 marks]
- (ii) Find the current through resistor, 25Ω . [3 marks]

**Figure Q1(a)**

(b) Consider the circuit shown in **Figure Q1(b)**.

- (i) Using **ONLY** source transformation technique, calculate the voltage across load resistor, R_L . [8 marks]
- (ii) Using **ONLY** superposition technique, again calculate the voltage across load resistor, R_L . [12 marks]

**Figure Q1(b)**

Continued...

Question 2

(a) Consider the circuit shown in **Figure Q2(a)**.

- (i) Identify all essential nodes and essential branches. [5 marks]
- (ii) Form and solve the nodal equations at node *b*, node *c* and node *d*. [8 marks]

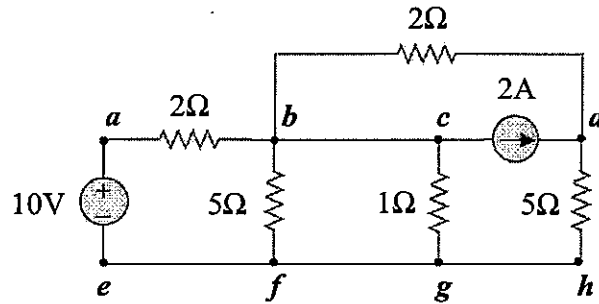


Figure Q2(a)

(b) For the circuit shown in **Figure Q2(b)**:

- (i) Solve the currents, i_1 , i_2 and i_3 using mesh analysis. [8.5 marks]
- (ii) Determine the voltage across the resistor of 2Ω and its power dissipation. [3.5 marks]

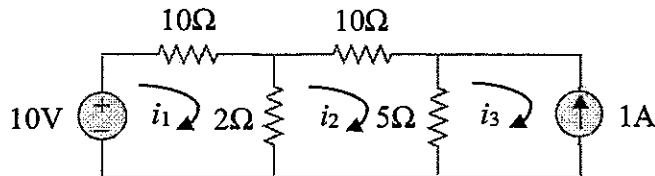
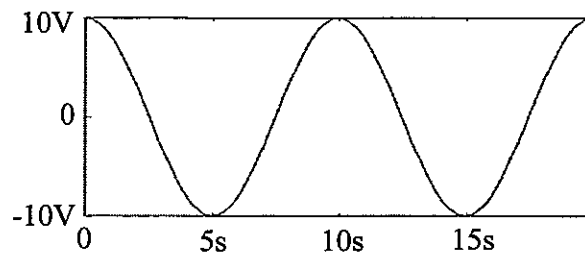


Figure Q2(b)

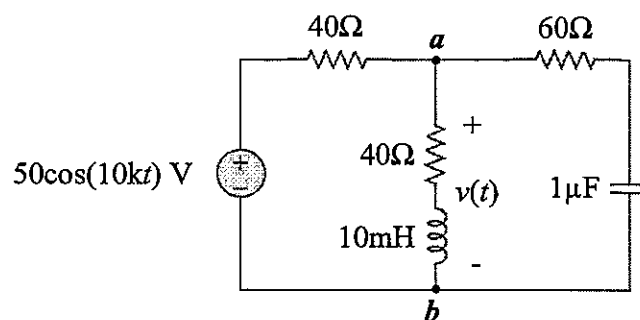
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Question 3

- (a) Given an alternating voltage, $V_{AC} = V_p \cos(\omega t)$ as shown in **Figure Q3(a)**.
- Determine the peak value, V_p , period, T and angular frequency, ω . [2 marks]
 - Rewrite the equation for V_{AC} in polar and complex form. [3 marks]

**Figure Q3(a)**

- (b) For the circuit shown in **Figure Q3(b)**, calculate the following:
- Total impedance. [4 marks]
 - Voltage between terminal $a-b$ (in term of cosine function). [3 marks]
 - Total supplied input power and power factor of the circuit. [6 marks]

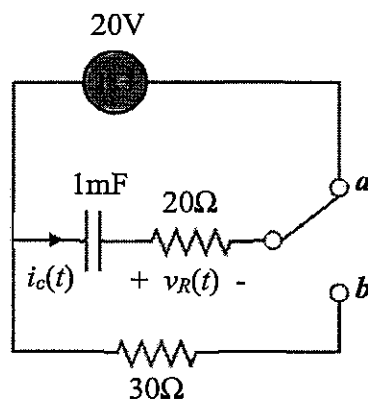
**Figure Q3(b)**

- (c) A series RLC circuit consists of a resistance of 1Ω , an inductor of 2mH and a capacitor of $3\mu\text{F}$.
- What is the condition to have a resonant circuit? [2 marks]
 - Calculate the resonant frequency. [2 marks]
 - Determine whether the circuit above is having high or low quality factor. [3 marks]

Continued...

Question 4

- (a) State the difference between transient state and steady state. Draw a waveform to illustrate the occurrence of these two states in a typical output signal.
[3 + 2 marks]
- (b) The switch of a RC circuit shown in **Figure Q4(b)** has been in position “a” for a long time. The switch moves to position “b” when $t = 1\text{s}$.
- Analyse the circuit by deriving the mathematical expression for the discharging voltage across the capacitor when $t \geq 1\text{s}$. [5 marks]
 - What are the values of the capacitor’s current, $i_c(t)$ and resistor’s voltage, $v_R(t)$ at $t = 1.1\text{s}$? [5 marks]

**Figure Q4(b)**

- (c) A source free **series** RLC circuit has a characteristic equation given as:

$$s^2 + 6s + 9 = 0$$

- Analyse the output response (underdamped, overdamped or critically damped) of the circuit. [3 marks]
- If the **series** RLC circuit has a capacitor of $1/9\text{F}$, what are the required values for inductor and resistor to meet the above characteristic equation? [3 marks]
- Based on the answer in part(c)(i) and part(c)(ii), form the output current equation given that the inductor has an initial current, $i(0) = 0.1\text{A}$ and an initial voltage, $v(0) = 5\text{V}$. [4 marks]

End of Paper